Claims:

1. A method of determining a stereo disparity between a reference image and a search image for a reference pixel in the reference image, said method comprising the steps of:

(a) calculating a similarity measure between a reference window including a set of pixels centering on the reference pixel and each of a group of search windows in the search image which is of a same shape with the reference window and displaced from the reference window within a predetermined search range, wherein a matching pixel count, which is the number of pixels in the reference window which are similar in intensity to corresponding pixels in a search window, is used as the similarity measure between the reference window and said search window; and

(b) determining a displacement between the reference window and a search window which yields a largest similarity measure as the stereo disparity for the reference pixel.

2. A method of determining a stereo disparity as defined in Claim 1, wherein R(x,y) represents the reference pixel, the reference window includes Wx*Wy pixels centering on R(x,y), Wx and Wy being predetermined numbers, each of the search windows includes Wx*Wy pixels centering on L(x+d, y) which is a pixel in the search image, d ranging from 0 to a predetermined number Sr, and

said step (a) includes:

(a1) calculating P(x,y,d) values as follows:

$$P(x,y,d) = 1, \text{ if } abs(B_R(x,y)-B_L(x+d,y)) \le Th$$
$$= 0, \text{ otherwise,}$$

where $B_R(x,y)$ and $B_L(x+d,y)$ represent intensity values of R(x, y) and L(x+d, y) and Th is a predetermined threshold; and

(a2) determining MPC(x,y,d) values for d=0 to Sr as follows:

$$MPC(x,y,d) = \sum_{w} P(x,y,d)$$

wherein w represents the reference window and the search window centering on L(x+d,y); and

said step (b) includes selecting a d value which yields a largest MPC(x,y,d) value as the stereo disparity for R(x,y).

3. An apparatus for determining a stereo disparity between a reference image and a search image for a reference pixel in the reference image, said apparatus comprising:

(a) first means for calculating a similarity measure between a reference window including a set of pixels centering on the reference pixel and each of a group of search windows in the search image which is of a same shape with the reference window and displaced from the reference window within a predetermined search range, wherein a matching pixel count, which is the number of pixels in the reference window which are similar in intensity to corresponding pixels in a search window, is used as the similarity measure between the reference window and said search window; and

(b) second means for determining a displacement between the reference window and a search window which yields a largest similarity measure as the stereo disparity for the reference pixel,

wherein R(x,y) represents the reference pixel, the reference window includes Wx*Wy pixels centering on R(x,y), Wx and Wy being predetermined numbers, each of the search windows includes Wx*Wy pixels centering on L(x+d, y) which is a pixel in the search image, d ranging from 0 to a predetermined number Sr, and

said first means includes:

(a1) a P-unit for calculating P(x,y,d) values as follows:

$P(x,y,d) = 1$, if $abs(B_R(x,y) - B_L(x+d,y)) \leq Th$

= 0, otherwise,

where $B_R(x,y)$ and $B_L(x+d,y)$ represent intensity values of R(x,y), and L(x+d,y) and Th is a predetermined threshold value;

(a2) a P-buffer for storing P(x,y,d) values from said P-unit;

(a3) third means for determining MPC(x,y,d) values for d=0 to Sr as follows:

$$MPC(x,y,d) = \sum_{w} P(x,y,d)$$

where w represents the reference window and the search window centering on L(x+d,y); and

said second means includes means for selecting a d value which yields a largest MPC(x,y,d) value as the stereo disparity for R(x,y).

4. An apparatus as defined in Claim 3, wherein said third means includes (Sr+1) MPC-units, each of which determines MPC(x,y,d) for each d value.

5. An apparatus as defined in Claim 4, wherein each of said MPC-units includes:

means for determining V(x,y,d) values which is represented as follows:

$$V(x,y,d) = \sum_{i=-wy}^{wy} P(x,y+i,d)$$

where wy is (Wy-1)/2;

means for generating a MPC(x,y,d) value by using V(x,y,d) values as follows:

$$MPC(x,y,d) = \sum_{i=-wx}^{wx} V(x+i,y,d), \text{ if } x=wx \text{ and}$$

MPC(x,y,d)= MPC(x-1,y,d)+V(x+wx,y,d)-V(x-1-wx,y,d), if x>wx,
where wx is (Wx-1)/2.

6. An apparatus as defined in Claim 5, further comprising a V-buffer for storing the V(x,y,d) values from said V determining means and providing the stored V(x,y,d) values to said MPC generating means.

7. An apparatus as defined in Claim 6,
wherein said V determining means includes:
a V_MP counter for determining V(x,y,d) values for by summing P values as follows:

$$V(x,y,d) = \sum_{i=-wy}^{wy} P(x,y+i,d)$$

a V_MP update unit for determining V(x,y,d) values by using V(x,y-1, d) and P values as follows:
V(x,y,d)=V(x,y-1,d)+P(x,y+wy,d)-P(x,y-1-wy,d); and
a multiplexor for selectively providing the V(x,y,d) value from the V_MP counter if y=wy and the V(x,y,d) value from the V_MP update unit if y≥wy; and
said MPC generating means includes:
a W_MP count and update unit for generating a MPC(x,y,d) value by using V(x,y,d) values; and
a multiplexor for selectively providing V(x,y,d) values from the V-buffer or 0 to the W_MP count and update unit as the V(x-1-wx,y,d) value.

8. An apparatus as defined in Claim 7, wherein

said V_MP counter includes a plurality of full adders;

said V_MP update unit includes:

logic gates for providing P(x,y+wy,d)-P(x,y-1-wy,d); and

full adders for adding the output from the logic gates to V(x,y-1,d), thereby providing V(x,y,d); and

said W_MP count and update unit includes:

means for deciding V(x+wx,y,d)-V(x-1-wx,y,d); and

means for adding the output from said deciding means to MPC(x-1,y,d).

9. An apparatus as defined in Claim 3, wherein said P-unit includes:

(Sr+1) D_R units each of which stores L(x+d,y) values for each d; and

(Sr+1) D_P units which provides (Sr+1) P(x,y,d) values for d=0 to Sr simultaneously in response to R(x,y) and (Sr+1) L(x+d, y) values from the D_R units.

10. An apparatus as defined in Claim 9, wherein the D_P unit includes:

means for calculating (B_L(x+d,y)-B_R(x,y)) which includes a plurality of full adders;

means for calculating an absolute value of (B_L(x+d,y)-B_R(x,y)) which includes a plurality of exclusive OR gates; and

means for subtracting the absolute value from Th and providing 0 or 1 depending on the result of the subtraction, which includes a plurality of carry generators.

11. An apparatus as defined in Claim 3, further comprising means for selecting a largest one among the MPC(x,y,d) values for R(x,y) and providing a d value yielding the largest MPC value as the disparity for R(x,y).

12. An apparatus as defined in Claim 3, where said P-buffer includes means for storing Ix *Wy*(Sr+1) P values, wherein Ix is the number of pixels in a row in the reference and the

search image.

13. An apparatus as defined in Claim 6, where said V-buffer includes means for storing Ix*(Sr+1) V values, wherein Ix is the number of pixels in a row in the reference and the search image.